F. LIFE AND ENVIRONMENTAL SCIENCE

***Content Standard**:* Students in Wisconsin will demonstrate an understanding of the characteristics and structures of living things, the processes of life, and how living things interact with one another and their environment.

***Rationale**:* Students will enhance their natural curiosity about living things and their environment through study of the structure and function of living things, ecosystems, life cycles, energy movement (transfer), energy change (transformation), and changes in populations of organisms through time. Knowledge of these concepts and processes of life and environmental science will assist students in making informed choices regarding their lifestyles and the impact they have on communities of living things in their environment.

Performance Standards: By the end of grade four students will:	***Sample Alternate Performance Indicators:* (1-3 per standard)**	***Sample Performance Activities/Tasks:* (1-2 per indicator)**	***Sources of Data***
F.4.1. Discover how each organism meets its basic needs for water, nutrients, protection, and energy in order to survive[1]	1. Identify the basic needs of organisms[1] 2. Discover how an organism meets its basic needs[2]	1.a. Identify the student's own basic needs(1) 1.b. Distinguish between survival needs and wants (2) 2.a. Raise and study an organism from birth to adult stage (2)	
F.4.2. Investigate how organisms, especially plants, respond to both internal cues (the need for water) and external cues (changes in the environment)[2]	1. Investigate how plants respond to internal cues[2] 2. Investigate how plants respond to external cues[2]	1.a. Record in a journal what happens to plants given different amounts of water (1/2) 2.a. Record in a journal what happens to plants kept at different temperatures(1/2)	
F.4.3. Illustrate the different ways that organisms grow through life stages and survive to produce new members of their type[2]	1. Identify prior knowledge of the life stages[1] 2. Illustrate an organism's life cycle[1]	1.a. Identify different life stages based on an experience with a pet or siblings(2) 2.a. Raise a classroom pet and record its growth through life stages(2)	
F.4.4. Using the science themes, develop explanations for the connections among living and non-living things in various	1. Identify living and non-living things[1]	1.a. Label things that are living or non-living(1) 1.b. Describe the differences between living and non-living things(2)	

environments[2]	2. Show connections between living and non-living things[2]	2.a. Create a poster or other visual to show how living things depend on non-living things(2)	
Performance Standards: By the end of grade eight students will:	***Sample Alternate Performance Indicators:* (1-3 per standard)**	***Sample Performance Activities/Tasks:* (1-2 per indicator)**	***Sources of Data***
F.8.1. Understand the structure and function of cells, organs, tissues, organ systems, and whole organisms[1]	1. Understand the structure and function of cells[1] 2. Recognize the relationships of cells, tissues, [1]	1.a. Draw a plant cell(1) 1.b. Draw an animal cell(1) 2.a. Illustrate the relationship of cells, tissues, organs, organ systems, and organisms(2)	
F.8.2. Show how organisms have adapted structures to match their functions, providing means of encouraging individual and group survival within specific environments.[2]	1. Show how organisms have adapted structures to match their functions, providing means of encouraging individual and group survival within specific environments (same as performance standard).[2]	1.a. Compare the modern horse to the Hyracotherium, a small horse from prehistoric times. Choose some characteristics (e.g., size and type of hooves) for comparison and discuss the similarities and differences. Discuss how the horse has changed and what factors may have caused those changes(3)	
F.8.3. Differentiate between single-celled and multiple-celled organisms (including humans) through investigations, comparing the cell functions of specialized cells for each type of organism[1]	1. Understand that specialized cells perform specialized functions in multiple-celled organisms (e.g., groups of specialized cells cooperate to form a tissue, such as a muscle)[1]	1.a. Dissect some chicken wings to identify connective tissue and muscle tissue(1/2)	
F.8.4. Investigate and explain that heredity is comprised of the characteristic traits found in genes within the cell of an organism[1]	1. Demonstrate that hereditary information is contained in genes, located in the chromosomes of each cell; each gene carries a single unit of information, and an inherited trait of an individual can be determined by either one or many genes[2]	1.a. Use construction paper to make a model of DNA and RNA(1) 1.b. Construct make-believe creatures (ReeBops) based upon the chromosomes and genes they receive(3) 1.c. Observe and record traits of parents and children and make a hypothesis as to which parent contributed each trait(3)	

F.8.5. Show how different structures both reproduce and pass on characteristics of their group[1]	1. Show how different structures both reproduce and pass on characteristics of the group[1]	1.a. Illustrate the stages of a butterfly's life cycle and a frog's life cycle. Compare the cycles and find another life cycle that matches the pattern(2/3) 1.b. Compare the offspring to the parent for the butterfly and frog(2) 1.c. Trace plant growth from seed, make illustrations and record observations(1)	
F.8.6. Understand that an organism is regulated both internally and externally[1]	1. Understand that an organism is regulated both internally and externally[1]	1.a. Compare two different species to show similarities and differences, then describe or illustrate the environment in which the species live (2) 1.b. Grow a variety of plants near a light source (1) 1.c. Determine a variety of migratory animals and, using a word map, identify reasons for their migration(1/2) 1.d. Determine a variety of hibernating animals and identify reasons for their hibernation(1/2)	
F.8.7. Understand that an organism's behavior evolves through adaptation to its environment[1]	1. Understand that when an environment changes, some plants and animals adapt to survive and reproduce, and others die or move to new locations[1]	1.a. Remove a water plant (elodea) from the ecocolumn aquarium, plant it in soil and record observations(1/2) 1.b. Choose an extinct or endangered animal and explain why it is extinct or endangered(1/2)	
F.8.8. Show through investigations how organisms both depend on and contribute to the balance or imbalance of populations and/or ecosystems, which in turn contribute to the total system of life on the planet[3]	1. Show through investigation how organisms are influenced by environmental forces and influence their environment in beneficial and detrimental ways[3]	1.a. Use a two-liter bottle to design an ecosystem. Include soil, water, and organisms that the ecosystem will sustain(3) 1.b. Make a list of recycled items. Create a classification system to identify the main characteristics of items that can be recycled(2/3) 1.c. Make a cause and effect chart to explain how recycling benefits the environment(2/3)	

F.8.9. Explain how some of the changes on the earth are contributing to changes in the balance of life and affecting the survival or population growth of certain species[2]	1. Explain how some changes on earth are contributing to the changes in the balance of life of a certain species[2] 2. Explain how some changes on earth are affecting the population growth of a certain species[2]	1.a. Examine through photographs the effects of acid rain(3) 2.a. Chart human population increases in a particular area and the effects of that growth on animal and plant life in the same area. Use graphic organizers to illustrate findings(3)	
F.8.10. Project how current trends in human resource use and population growth will influence the natural environment, and show how current policies affect those trends[3]	1. Project how current trends in population growth will influence the natural environment[3] 2. Project how current trend in human resource use will influence the natural environment and show how current policies affect those trends[3]	1.a. Research the effects of urban development on the endangered and extinct species. Graph population growth in these urban areas compared to endangered or extinct animals (3) 2.a. Compare the benefits of recycling today to 10 years ago(2) 2.b. Compare the number of trees required to supply one school with paper for one school year to the amount of paper recycled(2) 2.c. Research environmental laws and conduct mock debates.(3)	
Performance Standards: By the end of grade twelve students will:	***Sample Alternate Performance Indicators:* (1-3 per standard)**	***Sample Performance Activities/Tasks:* (1-2 per indicator)**	***Sources of Data***
F.12.1. Evaluate the normal structures and the general and special functions of cells in single-celled and multiple-celled organisms.	1. Evaluate the normal structures of cells in single-celled organisms 2. Evaluate the normal structures and general functions of cells in multiple-celled organisms	1.a. Construct a metaphor for the cell (e.g., factory or school) and illustrate and explain it 1.b. Observe the movement of materials into cell models made of dialysis tubing 2.a. Compare and contrast plant and animal cells 2.b. Explain how microscopes have advanced the knowledge of cells	
F.12.2. Understand how cells	1. Understand how cells differentiate	1.a. Compare and contrast plant and animal cells	

differentiate and how cells are regulated	and how cells are regulated	1.b. Explain the significance of the surface-area-to-volume ratio in terms of movement of materials into a cell	
F.12.3. Explain current scientific ideas and information about the molecular and genetic basis of heredity	1. Explain current scientific ideas and information about the molecular basis of heredity 2. Explain current scientific ideas and information about the genetic basis of heredity	1.a. Construct a "Ree Bop" from given chromosomes 1.b. Construct a DNA model and demonstrate replication 2.a. Explain how the structure of DNA determines the gene properties of replication, mutation, and transmission of information to succeeding generations	
F.12.4. State the relationships between functions of the cell and functions of the organism as related to genetics and heredity	1. State the relationships between functions of the cell and functions of the organism as related to genetics and heredity	1.a. Use appropriate symbols and diagrams to solve problems involving the major principles of genetics, 1.b. Construct a diagram illustrating the inheritance of an X-linked trait	
F.12.5. Understand the theory of evolution, natural selection, and biological classification	1. Understand the theory of evolution 2. Understand the theory of natural selection	1.a. Recognize issues involving human nutrition, fitness, and disease as viewed from an evolutionary perspective 2.a. Investigate the process of natural selection through a simulation game using colored paper dishes as prey and cloth fabric as habitat 2.b. Cut several colors of construction paper into small pieces and scatter them around outside in the grass. Pick up the pieces and discuss which colors were easiest to find and why	
F.12.6. Using concepts of evolution and heredity, account for changes in species an the diversity of species, including the influence of these changes on science (e.g., breeding of plants or animals)	1. Using the concept of heredity, account for diversity of species 2. Using the concept of heredity, account for changes in a species	1.a. Demonstrate how heredity accounts for the evolutionary history of a set of common birds 2.a. Compare various sizes and colors of a fruit (e.g., tomatoes)	
F.12.7. Investigate how	1. Investigate how organisms both	1.a. Design an ecosystem in a two-liter bottle. Identify materials	

organisms both cooperate and compete in ecosystems.	cooperate and compete in ecosystems	required (soil, volume of water, mass of sand, and types of organisms). Monitor the ecosystem's temperature, and sustain the ecosystem for four weeks ("Bottle Biology")	
F.12.8. Using the science themes, infer changes in ecosystems prompted by the introduction of new species, environmental conditions, chemicals, and air, water, or earth pollution	1. Using the science themes, infer changes in ecosystems prompted by environmental conditions 2. Using the science themes, infer changes in ecosystems prompted by water pollution	1.a. Observe the effects of temperature changes in water on fish by having a control group and cooling and/or warming the variable group's water 2.a. Observe photos or videos of an oil spill's effects on living organisms. Graph or chart the results of the student's research of the oil's effects on the organisms, living and dead	
F.12.9. Using the science themes, investigate energy systems (related to food chains) to show how energy is stored in food (plants and animals) and how energy is released by digestion and metabolism	1. Use the science themes to investigate energy systems (related to food chains) 2. Use the science themes to show how energy is stored in food (plants and animals)	1.a. Given the sample characteristics of a fictitious animal, identify its place in the food web 1.b. Create a pictorial food chain influenced by the sun 2.a. Use the order of the food web to identify where and how animals get their energy. Illustrate food webs of given ecosystems and relate the consumers and producers to energy	
F.12.10. Understand the impact of energy on organisms in living systems	1. Understand the impact of energy on organisms in living systems	1.a. Follow, through photos, a plant's seasonal changes (e.g., a tree). Illustrate a comparable cycle in a different climate and describe the changes that occur based on the impact of external energies.	
F.12.11. Investigate how the complexity and organization of organisms accommodates the need for obtaining, transforming, transporting, releasing, and eliminating the matter and energy used to sustain an organism	1. Understand that animals get energy from oxidizing their food	1.a. Use illustrations to show metabolism, respiration, diffusion, fermentation, ATP, osmosis, and active transport	
F.12.12. Trace how the sensory	1. Trace how the sensory systems of	1.a. Describe the reactions of various mammals to an extremely	

and nervous systems of various organisms react to the internal and external environment and transmit survival or learning stimuli to cause changes in behavior or responses	various organisms react to the external environment 2. Trace how the nervous systems of various organisms react to the external environment	bright light 2.a. Describe the reactions of various mammals to pain	